FAA Aviation News

OCTOBER 2000

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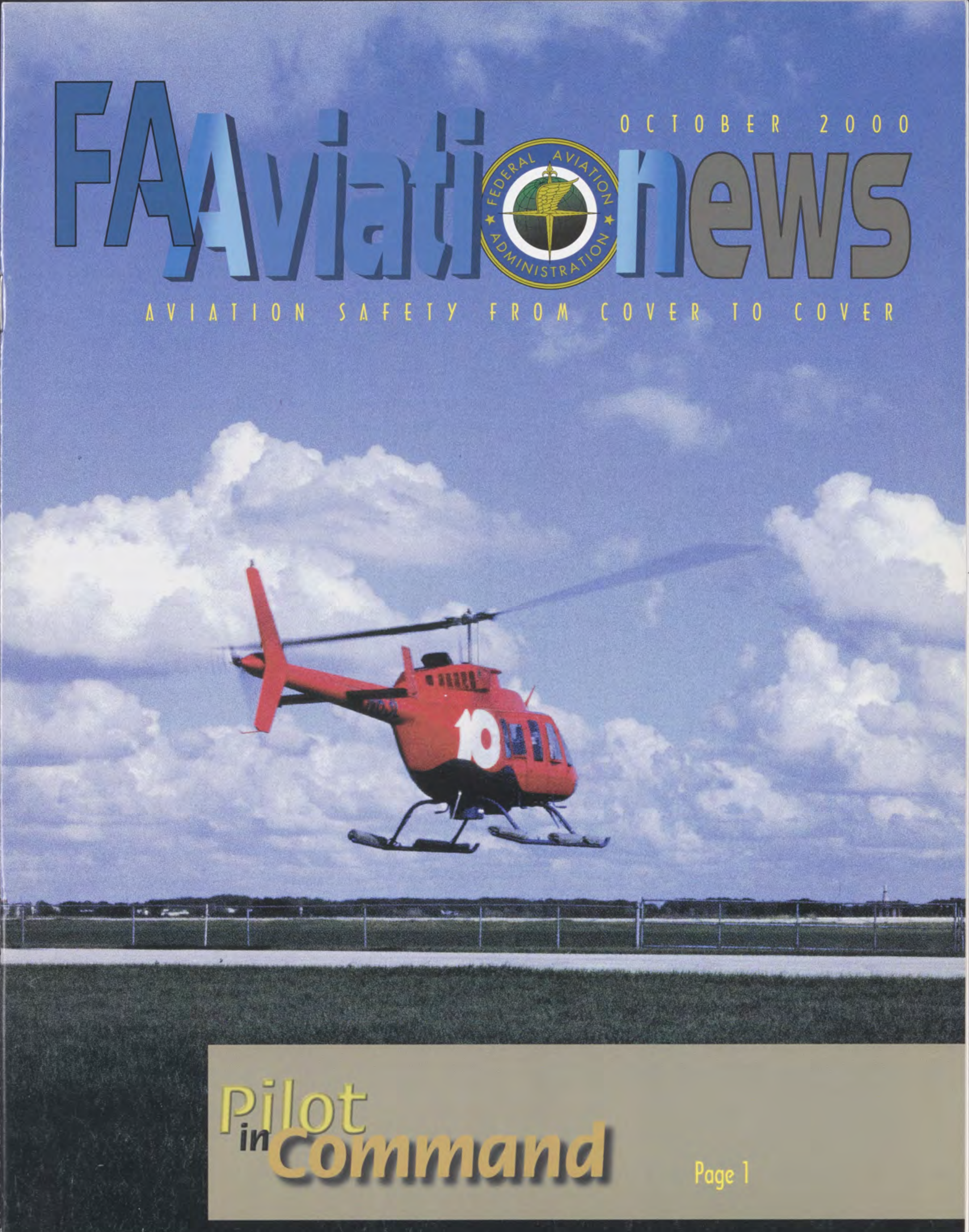

Pilot in Command

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OCTOBER 2000

FAA Aviation news

VOLUME 39 · NUMBER 7

FEATURES

DEPARTMENTS

FRONT COVER: A good day for news: clear and nothing to report! (Dean Chamberlain photo)

BACK COVER: Another great flying day around the mountains. (Dean Chamberlain photo)

Pilot in Command

There are two fundamental safety concepts in aviation. One is the "see and avoid" rule. Simply stated, all pilots have the responsibility to see and avoid another aircraft.

The second concept is equally as simple.

But the second one is more significant than the "see and avoid" rule. That concept and the rules that implement that concept define the profound responsibilities of "pilot in command." Pilot in command (PIC) includes all the historical and legal aspects one thinks about as being in command. Those responsibilities and accountability are there whether the pilot in command is flying a single-seat aircraft or a 400-passenger jumbo jet or something in between.

The next three articles in this issue highlight different aspects of being a pilot in command. Two deal with the PIC's responsibility towards passengers. The other talks about having the discipline to be PIC.

FAR §91.3, Responsibility and authority of the pilot in command, sums it up very well. That rule states in part, "(a) The pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft."

Cessna Photo

From the Cockpit or the Court... It's Your Choice!

"It was a warm tropical morning in southern Florida. The sun had risen about an hour before. It burned off the moisture from the sleek plexiglass™ windscreen by the time I picked up the three men at the Boca Raton Airport. I was to take them to a movie set, on location, at LaBelle.

"Fifteen minutes into the flight the engine began surging, the nose of the helicopter started turning left as torque between the engine and transmission lessened due to reduced power. I heard the low RPM audio come on, verifying my senses. I glanced at my RPM gauge…it was unwinding. It then decelerated to near idle. A couple of seconds later it quit.

"I had to bottom the collective to regain rotor RPM; continued loss of rotor RPM would mean we'd fall from the sky like a brick. I applied right pedal to bring the nose back to my 12 o'clock position to complete my entry into autorotation.

"I was headed towards the only opening on the edge of Lake Okeechobee, about a quarter of a mile away.

"I had to stretch the glide just to get to the clearing, so when we were past the trees there wasn't a lot of rotor RPM left and we came down hard. I heard metal crushing and felt my teeth gnash. I immediately smelled hot oils and burnt rubber. The landing had been rough enough to cause the upslope skid to collapse, and sever the

tail boom."

"What did you then do?"

"I watched my passengers die!"

"Mr. Allen, don't you mean you watched passengers die that YOU KILLED?"

Sound in the courtroom came to a roar as I finally came out of my trance; my inner thoughts. I was about to get on the witness stand for real, and testify to the events that took place last July. My heart was pounding. My palms were sweaty and my mouth was completely dry as the trial began.

"Ladies and gentlemen of the jury, my name is Lance Scott, and I represent these three grieving families. These families have a common bond; for they all lost loved ones in the fatal crash of a helicopter last July. I will prove to you that the pilot of that helicopter not only acted in an unprofessional manner, but he was also grossly negligent in his preparation for flight. I have no doubt that after hearing the testimony you will agree."

"The court calls Mr. Henry Allen to the stand."

Scott slowly paced back and forth, his eyes firmly fixed on Allen. "Mr. Allen, could you describe the flight in which you were pilot in command on the morning of July 22?"

"I picked up three passengers at the Boca Raton Airport, then headed west towards LaBelle."

"Describe for the jury what happened during that flight."

"While enroute I experienced a power loss and was forced to land in a small clearing on the edge of Lake Okeechobee."

"Would you describe the landing area, please?" Scott resumed his pacing, he could see that it was unnerving Allen. Allen was irritated by the attorney's pacing. It seemed that every time he answered a question, Scott had his back to him. It was as if the answer wasn't important, only the question.

"It was approximately 60 feet in diameter, covered with sawgrass and other vegetation, some rocks, and 20 to 30 foot tall trees.

"We hit pretty hard. Then one of the blades hit the tail boom and I think we bounced. There was a lot of noise and dust, and loose objects were flying around the cockpit and cabin."

"Was the engine still running and were the rotor blades still turning after the crash?"

"Yes."

"When did the fire start?"

"I'm not sure."

"Well, was the aircraft on fire while you were still in it, or did it start after you exited the wreckage?"

"I noticed smoke coming from somewhere behind me and I yelled for everyone to get out. The guy in the left front seat was already climbing out so I jumped out and ran. When I'd gone about 50 feet, I stopped and looked back only to see my helicopter in flames."

"When you stopped and looked back, where were your passengers?"

"I couldn't see the front seat passenger, but since he got out his side at the same time as I was leaving my side, I assumed that he was hidden by the smoke and was all right."

"What about the rear-seat passengers? Where were they?"

"They were still in the aircraft."

"Were they unconscious?"

"No." Allen was visibly shaken now. His face was flushed and perspiration was starting to bead above his upper lip. He wrung his hand, stopping occasionally to wipe his sweating palms on his pants.

"How could you be sure they were conscious?"

"Because I could see 'em struggling and hear them screaming."

"Did you try to help them?"

"Yes, but the flames were too intense to get near the helicopter," whispered Allen. "One was beating on the plexiglass™ with his fists while the other seemed to be struggling with his seat belt."

Allen was almost destroyed by now. His voice was cracking and tears were rolling down his face.

"Where was the front seat passenger?"

"I moved around the front of the aircraft and saw him lying on the ground, about 10 feet upslope from the helicopter."

"Tell the court what you saw as you approached that passenger."

"He had a very large open wound on the right side of his head."

"What do you think caused the injury to the passenger's head?"

"I believe he was struck by the rotor blade when he ran upslope from the helicopter."

Allen thought to himself "I did everything the way I've always done it. It's not my fault that the engine quit. In fact, I think I did pretty good just getting it to the only open spot on the lake. I'm sorry those guys were killed, but what could I have done differently? It's not my fault that the guy ran up into the rotor blade, or one of them couldn't get his seat belt off, or the other didn't know how to open the door."

Allen was jarred from his thoughts when Scott resumed.

"Mr. Allen, do you consider yourself a professional pilot?"

"Yes."

"The term 'professional pilot' would imply that you were, or should be, more competent and skilled and have a higher set of standards than the pilot who does not fly for a living. Would you agree with that, Mr. Allen?"

"Yes, I suppose."

"And shouldn't these higher standards apply to the safety of your passengers, before takeoff, during, and after the flight?"

"Yes," Allen answered, avoiding Scott's eyes.

"Are you familiar with the federal aviation regulations, Mr. Allen?"

"Yes."

"And do you abide by these regulations, Mr. Allen?"

"Yes, I do."

"Does your company have a manual that indicates how you are to operate its helicopters?"

"Yes."

Allen was starting to sweat again. His mouth was dry. He took a drink of water and noticed that his hands were trembling.

"Do you understand and follow the instructions laid out in this manual?"

"Yes," he whispered.

"Don't your company manuals and the regulations, which you have read and follow, require that you give your passengers a thorough and complete briefing before flight, including a thorough safety briefing covering how to exit while the rotor blades are turning, how to operate the emergency exit, and how to operate the seat belt release?"

Allen's throat was too dry for him to speak and he felt the tears swell in his eyes.

In his summation to the jury, Scott stated, "Ladies and gentlemen of the jury, you have listened to testimony regarding the helicopter accident of July 22, which resulted in the tragic and senseless deaths of three passengers."

"We have established that all three died not on impact, but as a result of post-impact circumstances. In fact, they were not even seriously injured as a result of the initial impact. One safely escaped from the wreckage, only to be struck and killed by one of the still turning rotor blades. Another died because he was unfamiliar with and could not open the seat belt buckle. The last died because he didn't know how the door release operated or how to activate the emergency release. The question that you must answer is who is responsible for these three tragic deaths?"

"The answer, ladies and gentlemen of the jury, is the pilot is responsible, for he failed to carry out his duties as a professional pilot."

Quick Turn photo

Although this story involved a helicopter and is a parable, this forced landing could have happened in a seaplane, a five or nine passenger twin, or even a four place single.

Responsibility for the flight, and all that takes place from "lighting the fire" to tie-down, is yours and yours alone. There is only one pilot in command. Assume that none of your passengers know anything about your aircraft!

Your passengers will have a lot more respect for a professional approach to your duties than a cavalier Dapper Dan.

Regardless of what part of the regulations you're flying under, anytime you carry passengers you should brief them, and your briefing should include the following:

- Location and operation of the emergency locator transmitter (ELT).
- Operation of all doors and windows.
- Operation of seat belts and shoulder harnesses.
- Location and operation of fire extinguisher.
- Location of first aid kit/survival gear.
- Hazards associated with main and tail rotor or propellers.

Your briefing can mean the difference between doing it right or having to tell it to a judge why you did not.

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The original article appeared in a Transport Canada publication, Vortex, but was shortened and revised by Safety Program Manager Cary Mendelsohn to appear in the Fort Lauderdale (FL) Flight Standards District Office's newsletter, Life Lines©.

Underwater Egress

by Larry West

A preflight can become a routine litany until an emergency happens. When flying over water, make sure your passengers know what to do in case you have to ditch the airplane in water. The following article is about such an emergency that went fatally wrong.

On July 20, 1996 a float-equipped Cessna U206F with six people on board, including three children, began its takeoff run from the Riviere des Prairies, Quebec, Canada for a flight to the Gouin Reservoir. The Robertson STOL-equipped aircraft lifted off quickly, but settled back to the water in a pronounced nose up attitude. The pilot continued the take off, and the aircraft lifted off a second time. The left wing then dipped, struck the water, and the aircraft capsized. A person who had witnessed the accident proceeded immediately to the scene to assist the occupants. The witness opened the left front door and a female passenger and her child evacuated the airplane. The pilot and the other three passengers, including two children, drowned inside the airplane.

This disturbing accident raises many questions. The Canadian Transportation Safety Board report lists the pilot's decision to use 20 degrees of flaps for take-off and the strong crosswind with gusts estimated at 20 knots as causal factors. However, the report goes on to point out that the passenger distribution and the difficulty in opening the rear cargo doors were the main factors resulting in four fatalities in this otherwise survivable accident. It is these two elements of this tragic event that we will discuss further.

Seating Arrangement

The Cessna 206 is a six place aircraft with seats arranged in three rows, two seats per row. The passenger seating arrangement for this particular flight was as follows:

— The adult male passenger was seated in the front right seat next to the pilot.

— The adult female passenger was seated in the middle row behind the pilot, with her two year old daughter on her lap.

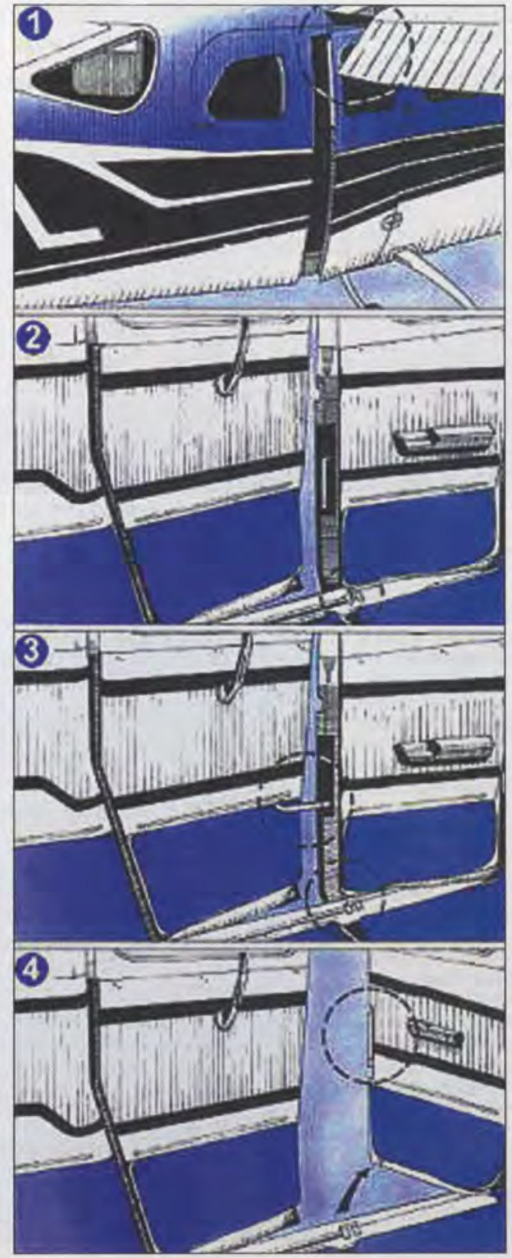
— A six year old child was seated to her right, adjacent to the forward leaf of the cargo door.

— A nine year old child was seated alone in the back row in the right hand seat next to the aft leaf of the cargo door.

All of the passengers were given headsets with microphones prior to taxi. The surviving female passenger stated that the pilot briefed the passengers during taxi using the intercom. However, she had removed her headset to assist one of the children and did not hear the entire briefing. Therefore, we will never know just what information was given regarding the use of the emergency exits. What we do know is that the seating arrangement on this flight was less than ideal and may have contributed to the fact that no one was able to exit through the rear cargo doors.

Emergency Exits

The 206 is equipped with a single cockpit door on the left side adjacent to the pilot's seat. In addition, there is a double leaf cargo door on the right hand side of the aft fuselage that doubles as an emergency exit. In order to open the rear cargo door the forward leaf must be opened first. This exposes the handle for the aft leaf, which is located on the forward vertical jamb of the aft leaf. The person seated in the middle row right hand seat is in the best position to open the door. This door would be the primary exit for anyone seated there and for anyone seated in the aft row. Since the forward leaf must be opened first, it has a large handle mounted prominently on the inside with an arrow indicating the proper direction of rotation to open. A problem arises when the flaps are set for take-off or landing, the forward leaf will only open about three to four inches before it contacts the inboard edge of the right flap. To further complicate this situation, the handle for the aft leaf



1 Rotate handle and open forward leaf until it contacts flap.

2 Locate handle for aft leaf

3 Rotate aft leaf handle down to unlatch.

4 While pushing aft leaf open, rotate handle back toward latched position until handle clears the forward leaf, ensure that latch does not re-engage (as well as the placard describing the lever operation) is somewhat hidden by the backrest of the middle row seat. A person seated in the aft row can not clearly see the handle without leaning forward over the seat in front of them. Unfortunately, it does not end there. One more complication in the process of opening the cargo door remains. Once the handle for the aft leaf is finally located and rotated down to a horizontal position to open the door, the handle will strike the inside of the slightly open forward leaf, preventing the aft leaf from opening. In order for the handle to clear the forward leaf, it must be rotated back toward the closed position, which could possibly cause the latch to re-engage. The drawings on page 5, courtesy of Transport Canada, illustrate the process of opening the cargo door from the inside with the flaps down.

Don't Let This Happen to You

If you fly a Cessna 206 that is operated over water, regardless of whether it is equipped with floats or not, you need to be cognizant of this situation. We suggest that you frequently practice opening the cargo door, both from the inside and the outside with the flaps down. You should be able to do it in the dark, with one hand, and standing on your head, since this is how you may have to do it someday. The same goes for the people who fly with you on a regular basis. Your passengers may need to open the door one day without your assistance. Commercial operators of the 206 should include this training in their FAA-approved pilot training program. In addition, commercial pilots should, when boarding their passengers, give special consideration to who among them would be best suited to opening the cargo door in an emergency. Brief that person thoroughly on the door operation and seat him/her accordingly. The person in that seat will have the responsibility for opening the rear cargo door in an emergency. . Never seat a child in the middle row right hand seat. Finally, we recommend that when operating on floats from rough water or in other similarly unforgiving situations, consider limiting your seating capacity to four people. By not using the aft row of seats, you will not only reduce your take-off run, but will give your passengers better access to the forward left hand door.

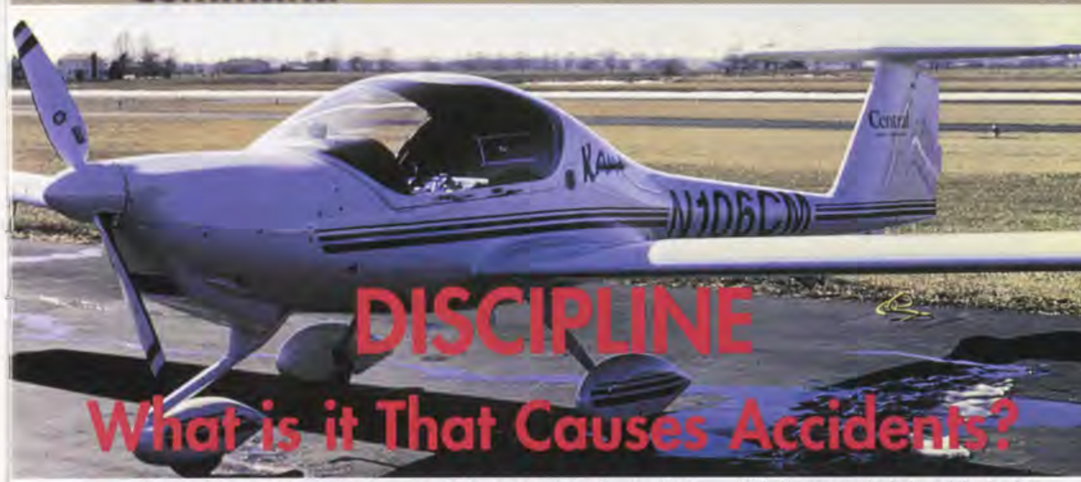
Conclusion

There have been at least three fatal accidents in Canada involving Cessna 206 model aircraft that ended up in the water. One in 1984, the 1996 accident discussed here, and yet another, occurring less than twelve months later. The most recent accident involved a U.S. registered aircraft, and occurred when an amphibious float equipped 206 landed gear down in the water at Carroll Lake, Ontario. This seemingly survivable accident resulted in two fatalities and has helped to bring this issue to the forefront in the Transport Canada Safety Program. In the U.S., and especially here in Alaska, we need to do more to educate people on this subject. You can help by continuing to educate yourself, your fellow pilots, and your passengers. Bring this subject up at your next company safety meeting or next "hanger flying" session. Attend FAA or industry sponsored safety meetings whenever and wherever you can. Formulate and practice an emergency egress procedure for your aircraft and attend formal egress and survival training if possible. Remember, there is no such thing as too much preparation.

Larry West is a Aviation Safety Inspector at the Juneau, Alaska, Flight Standards District Office. Information for this article was obtained from Transport Canada Aviation Safety Letter issue 2/98, and Canadian Transportation Safety Board report A96Q0114. The analysis of this accident is strictly for the purpose of advancing transportation safety.

Maintenance Considerations

In 1991 Cessna issued a Service Bulletin, SEB 91-04, which introduced a modification to the aft cargo door handle mechanism. This bulletin incorporates a spring to raise the handle after actuation, preventing it from striking the forward door and eliminating one of the steps involved in opening the door. The bulletin also adds two new placards, one on the forward leaf and one on the aft, to aid in locating the aft door handle. We strongly recommend that this bulletin be incorporated on all Cessna 206 aircraft, especially those equipped with floats or operated over water. Maintenance personnel should be made aware of the importance of checking the latch mechanism for proper rigging and serviceability and the placards for legibility during routine maintenance and inspections. The new 206H and T206H aircraft currently being produced incorporate the provisions of SEB 91-04.



DISCIPLINE
What is it That Causes Accidents?

Anyone who has been involved in the aviation industry could, in just a few minutes, come up with a list of known causes. Collectively, such lists would unquestionably include the following: loss of control due to spatial disorientation, misperceptions, colliding with unseen obstructions, assumptions, failure to maintain control, expectations, system malfunctions, fatigue, lack of knowledge or skill, inexperience, distractions, etc. Each of these causes could be attached to any number of accidents.

There is one other that has two sides to it—lack of discipline. The ordinary way to imagine lack of discipline can be exemplified by the following accounts taken from the U.S. National Transportation Safety Board's (NTSB) accident files.

Witnesses observed the pilot buzzing a building, and rolling the Piper PA-12 airplane about its longitudinal axis. After the third pass, it entered a steep bank, stalled, and pitched down into a wooded area. There was evidence that the aircraft was at least 73 pounds over its maximum gross weight limit. The center of gravity was not verified, but the elevator trim was found full nose down, and cargo was found in a position that would have moved the center of gravity aft. A toxicology check revealed traces of cannabinoids (hemp) in the pilot's urine.

The pilot said that after concluding the daily tour contract with 206B, it was to be parked at a hangar. En route to the hangar, the helicopter was intentionally flown near a farm irrigation sprinkler system in an attempt to wash off the accumulated dirt. After the second pass through the water stream, the engine out warning light and audio warning was activated and the engine quit. The helicopter landed hard during the subsequent autorotation to an unimproved dirt road.

A witness reported seeing the Cessna 150 enter a dive and level off approximately 10-15 feet above the ground. The aircraft continued flight close to the ground for approximately one-half mile before a near vertical climb was entered until the aircraft stalled. Recovery from the stall was not made and the aircraft impacted the open terrain. No mechanical or physical problems were discovered during the investigation, which would have contributed to the accident.

The pilot was attempting to give himself a checkout in the Sikorsky S-58 helicopter, as he believed the fee for a check flight was too expensive. During a second attempt at hover flight, he positioned himself with a 90 degree, 12-knot right crosswind. As the aircraft became light on the wheels it began rolling uncontrollably to the left. His ground crew stated that at this point the main rotor blades made ground contract. Full cyclic control was needed to right the aircraft after it became airborne; however, the aircraft continued to drift to the left. A hard landing was made to get the aircraft on the ground at which time the left main landing gear failed and the main rotor blades again touched the ground.

According to the witnesses, the pilot completed a short checkout in the Cessna 152 and then boarded a female companion in the rented aircraft. He took off and flew to a point three miles from the airport. The aircraft was observed by numerous ground witnesses to perform a "series of wingovers at low altitude," with entry altitudes estimated at 300 feet and lower above ground level. A police officer observed that "each successive entry altitude was slightly lower than the previous one, with the corresponding recovery altitudes lower as well" until the aircraft impacted in a vacant field in a residential area. The police *officer noted that the recovery attitude on the first wingover was "about the height of the telephone poles." The coroner's office reported that a relative of the passenger lived about 1.5 miles from the accident site.*

One view of a lack of discipline is a person who chooses to operate outside the known bounds of policy, procedure, limitations, regulations, or prudence. The previous NTSB accounts would appear to be examples of that type of a lack of discipline. The other view of a lack of discipline is the situation where a person operates in an atmosphere without effective direct supervision.

The imposition of discipline, or supervision, varies throughout aviation. U.S. Federal Aviation Regulation (FAR) Part 121 operators and the military may be considered to have the most rigid organizational structure vested with the authority and responsibility to monitor for adherence to the appropriate organizations. Operations under other FAR parts, of course, have defined structures and effective supervision of aviation operations too. But, the argument can be made that operations under General Operations and Flight Rules, Part 91, require the least in the way of direct supervision. The ultimate example of that might be the private owner and recreational pilot—who has no corporate boss or director of operations or chief pilot to observe his/her activities. Such a person would have no defined organizational supervision, except that provided by the regulators.

It would be hasty to suggest that (1) a lack of direct supervision automatically results in a lack of self-discipline, and (2) the antithesis is that the existence of a rigid organization of supervision assures adherence to the rules. The trite old phrase that "When the cat's away, the mice will play," does, however, hold some truth. It's not unusual for even the most diligent person to relax some when the boss is gone. When there is no boss, the temptation is even greater to be selective in the extent to which rules are obeyed.

The lack of self-discipline is not peculiar to a person who has no rigid organizational structure of direct supervision. One can find examples of airline and military pilots who have intentionally and willingly violated rules, regulations, policies, and procedures. Why do we sometimes show a lack of self-discipline? It could be for either of two major reasons: (1) Ignore the Negatives, and/or (2) See the Positives.

Some of these negatives that are ignored could be *Potential* to harm self and others, *Actual* damage to aircraft, *Detection* by supervisors/regulators, and *Liability* for punishment. Positives that are seen could include *Minimizing* personal time and effort, *Saving* company money, and *Accomplishing* the mission.

Ignore the Negatives

Potential to harm self and others almost always exists in the flying business. But intentional prolonged flights at low level/high speeds, continues operations within the HV Diagram, or beyond the published performance limits may needlessly raise the exposure of pilots, passengers, and others to harm.

It is not unusual for hot starts, overtorque excursions, or flying at weights over max gross limits to go unreported. Somehow the embarrassment of admitting to such violations can seem more important than having the extra wear on the aircraft looked at by maintenance and made known to other pilots.

Being caught doing something wrong and the exposure to being punished is a potent deterrent. The potential for losing a job or losing a life has, at times, been shown to be not enough of a deterrent to resist the thrill of flying under the bridge, or buzzing your neighbor's house, or trying an aerobatic [maneuver].

See the Positives

Operational situations are ripe with opportunities to justify breaking the rules in order to get the job done. Justification can be made for all sorts of violations big and small. Taking that load of unpackaged hazardous material along with the passengers can save having to make another trip. Using the wrench at hand instead of walking across the hangar for the torque wrench will save time. Besides, it's not that important, and no one is here to see.

There are all sorts of reasons why lack of self-discipline can be justified. And, there are many organizational situations where supervisory imposition of discipline is not easy or effective. There is only one solution to either case. THAT SOLUTION IS INTEGRITY...a quality within that maintains the state of order and submission to rules and authority without the need for anyone besides yourself.

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SAFETY IN AND AROUND HELICOPTERS

The Rotorcraft Flying Handbook (FAA-H8083-21) provides safety guidelines for persons associated with helicopter operations and suggests ways to avoid hazards and reduce the risk of accidents. The information in this publication pertains primarily to helicopter operations conducted under the provisions of Part 91; however, the safety considerations discussed may be applicable to all helicopter operations. It is available from the Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954. The cost is $24.00.

Aircraft Fuel Tank Maintenance Presents Unique Atmospheric Hazards

by Victor J. Vendetti and James W. Allen, MD, MPH

Ever since TWA Flight 800 exploded shortly after takeoff from New York's John F. Kennedy International Airport, killing all 230 passengers and crew aboard, aviation safety experts have pointed toward the 747's center-wing fuel tank as the possible explosion source. Three years later, industry experts still are pointing toward the 747's center-wing fuel tanks, this time as part of a federally mandated inspection and maintenance program (Federal Aviation Administration Airworthiness Directive [64 FR 4959 No. 2102/02/99]). There are other Airworthiness Directives addressing the center tank, as well as the rest of the 747 aircraft, as a result of the ongoing investigation.

The aim of the directive, in the long term, is to make the jumbo jets safer for flying. In the short-term, however, the jets present additional hazards on the ground for aircraft maintenance technicians. That's because the inspection, repair, and maintenance procedures for 747 fuel tanks and other large passenger and cargo planes require that technicians must physically enter them. Located on aircraft wings and beneath the fuselage, the fuel tanks are small, confined spaces which pose numerous potential dangers, including fire, explosion, toxic chemical exposure, and oxygen deficiency or enrichment conditions. Clearly, it's a perilous working environment, and one that requires extreme caution.

Fuel Tanks Are Confined Spaces

While aircraft technicians long have worked inside fuel tanks, the FAA Airworthiness Directive covers 1,140 U.S.-registered 747's (there are 2,780 such aircraft in use worldwide), requiring corrective measures within the four-year compliance period. (These measures are required for all 747 aircraft flying in U.S. airspace.) Specifically, the fuel tanks of each plane must be inspected, fuel system wiring modified, and new fuel vent system flame arrests installed. The agency estimates that each plane requires 326 work hours to complete the requisite maintenance. This translates into more technicians entering more potentially hazardous fuel tanks more frequently.

Work inside aircraft fuel tanks can be generously described as "restrictive." Entry into most is through an oblong hole measuring approximately two feet by one foot. (0.6 m by 0.3 m). Most wing-stub tanks and wing center-section fuel tanks are large enough to allow maintenance personnel to completely enter the tank. The tank space, however, becomes progressively smaller until a technician is forced to lie on his or her stomach, with just a few inches of headroom.

Inboard of the plane, wing tank access holes offer only enough clearance for a technician's head, shoulders, and trunk, leaving the legs outside of the access hole. The further outboard on the wing, the smaller the tank becomes until only a person's hands and arms will fit inside.

Aircraft fuel tanks meet the Occupational Safety and Health Administration's (OSHA) classification of a confined space, and operations within them are governed by OSHA's confined space standard (29 CFR Part 1910.146). (See accompanying article.) While the FAA is responsible for safety of the aircraft, the agency is not responsible for the safety of the technician. Other governmental agencies have that responsibility. Also, state and local laws prevail, but are little understood.

Atmospheric Hazards within Fuel Tanks

Although the interior dimensions of fuel tanks vary considerably from one aircraft type to the next, all of them have a limited volume. And, therefore, even a relatively small amount of a hazardous substance inside one of these confined spaces can create significant levels of flammable or toxic vapor.

There are a number of different atmospheric hazards unique to the inside of aircraft fuel tanks. Naturally, the leading problem is jet fuel vapor concentration. Commercial carrier jet fuels (jet A and Jet A-1) are kerosene-based, and often are mixed with other compounds, such as naphthalene—although refineries may blend other available hydrocarbons to meet jet fuel specifications. Jet fuels also are flammable and may ignite given certain ambient conditions—primarily temperature and vapor concentration.

Other VOC's (volatile organic compounds) used in integral fuel-tank work, such as cleaning solvents, sealants, and lubricants, can be even more harmful than jet fuel and may mix with other compounds present to create significant, immediate health problems. All sealants and lubricants are controlled by OSHA and verified before use. Many of the items that have proved harmful have been banned or their use restricted. [Check with OSHA for more detailed information.]

Management of the chemical exposure and oxygen content inside the fuel tank is one aspect of compliance with an OSHA standard. Safety and health professionals also must recognize the biological risks from subtle overexposure that may exceed an OSHA permissible exposure limit (PEL). Case reports of chronic exposure to solvent mixtures, such as in fuel or released from hazard waste sites, have been implicated in causing cognitive and motor performance deficiencies, reproductive deficits, and cardiac arrhythmia. While these medical consequences are by no means proven, a well-designed medical surveillance program for those working in the fuel tanks may aid in controlling future compensation claims based on allegations of exposure exceeding a PEL.

Another potential problem within the tanks is oxygen deficiency. Oxygen deficiency often is caused by physically displacing the oxygen in a space. For example, oxygen deficiency can occur when natural oxidation takes place. Normal ambient air contains an oxygen concentration of 20.8 percent by volume. At oxygen-deficient levels (19.5 percent by volume and below), a person will begin to exhibit signs of oxygen starvation, including headache, nausea, drowsiness, and slurred speech. At increasingly lower oxygen concentrations, more severe reactions occur. Ultimately, death by asphyxiation is possible.

Detecting Unseen Hazards

To ensure the safety of the aviation maintenance technician, close monitoring of the work environment is necessary. As with any confined space, atmospheric testing must be performed before initial personnel entry. This testing will inform the entrant of any potentially hazardous conditions and ensure safe entry. Proper testing should be conducted with a calibrated, direct-reading instrument and include the evaluation of oxygen content, flammability, and suspected toxic substances. The instruments can be preset at the factory or set in the field. Atmospheric testing should evaluate the current status of the space, as well as verify that entry conditions remain acceptable.

An environmentally unsafe or explosive vapor concentration is present when a fuel vapor reaches a level known as the lower flammability limit

Figure 1

CARBON MONOXIDE (CO) POISONING

Carbon monoxide is a colorless, odorless gas generated by the combustion of common fuels with an insufficient supply of air or where combustion is incomplete. It is often released by accident, by improper maintenance or adjustment of burners or flues in confined spaces, or by internal combustion engines.

Called "the silent killer," CO poisoning may occur suddenly and without warning.

PPM LEVEL	PHYSIOLOGICAL EFFECT
220 ppm for 3 hours or 600 ppm for 1 hour	Headache and discomfort
1,000 ppm for 1 hour or 500 ppm for 30 minutes	Pounding heart, dull headaches, dizziness, flashes before eyes, ringing in ears, nausea.
1,500 ppm for 1 hour	Dangerous to life.
4,000 ppm	Rapid collapse, unconsciousness and death within seconds.

Source: MSA

Figure 2

OXYGEN (O_2) DEFICIENCY

OSHA has established the safe oxygen range for confined space entry (without the use of auxiliary air supplies) to be between 19.5 and 23.5 percent by volume. As long as readings remain within this range, the oxygen content is considered to be safe.

When the oxygen level rises above 23.5 percent by volume, the atmosphere is considered to be oxygen enriched and is prone to instability, such as flash fire and sudden explosion.

When the oxygen level dips below 19.5 percent by volume, the area is considered to be oxygen deficient. The impact of oxygen deficiency can be gradual or sudden, depending upon the overall oxygen concentration, activity levels of the workers in the space, and the concentration levels of other gases in the atmosphere.

% OXYGEN	PHYSIOLOGICAL EFFECT
19.5-16	No visible effect.
16-12	Increased breathing rate. Accelerated heartbeat. Impaired attention, thinking, and coordination.
14-10	Faulty judgment and poor muscular coordination. Muscular exertion causing rapid fatigue. Intermittent respiration.
10-6	Nausea, vomiting. Inability to perform vigorous movement or loss of the ability to move. Unconsciousness followed by death.
Below 6	Difficulty breathing. Convulsive movements. Death in minutes.

Source: MSA

(LFL) or lower explosive limit (LEL). These limits are usually expressed as a percentage by volume. Different types of jet fuels can have different LEL's. For instance, 100% LEL of Jet A fuel is 6,000 parts per million (ppm), while 100% LEL of JP-4 is 13,000 ppm.

Unfortunately, because of the existing technology of gas sensing devices, jet fuel vapors have been difficult to accurately detect. Traditionally, most gas sensors have relied upon catalytic technology calibrated for pentane or methane. However, this technology generally is not conducive to detecting combustibles with flash points at or above the 100°F (38°C) level. Flash points for jet fuels typically are above 100°F. The potential risk here is that catalytic sensors may underestimate jet fuel vapor concentration because high flash point fuels affect a sensor's ability to properly function.

Also, catalytic sensors generally are not designed for low-level (sub-ppm) leak detection, but rather display gas concentrations in terms of % LEL. Often times, the catalytic sensors do not display readings until 1% LEL is reached. Since a reading of 1% LEL of Jet A is the rough equivalent of 60 ppm, up to 59 ppm of Jet A may be displayed as 0% LEL by catalytic sensors. This difference means that a gas concentration exists and may go undisplayed or significantly understated by catalytic sensors. These undetected hazardous gases may well be a contributing factor in the long-term, chronic illnesses associated with fuel-tank maintenance personnel.

Further complicating accurate jet fuel vapor detection is the fact that there is no singular compound that is "jet fuel." For instance, Jet A and Jet A-1 are comprised of different compounds (as are the military jet fuels, JP-5 and JP-8), and the constituents of Jet A can differ from one manufacturer to another—even from batch to batch. The mix is further altered at an airport as different batches are added to the storage tanks.

There are, however, devices that are capable of effectively monitoring jet fuel regardless of flash point. These instruments, which utilize photoionization (PID) technology, also generally can detect gas and vapor concentrations at much lower levels than catalytic technology. For instance, certain PID's can display Jet A at .1 ppm, compared to catalytic sensors that generally begin detecting Jet A at 1% LEL (which, again, is equal to approximately 60 ppm of Jet A).

PID's use ultraviolet light to ionize molecules of chemical substances in a gaseous or vaporous state. The monitors use microprocessor technology to provide real-time digital readouts, enabling the user to immediately determine gas or vapor concentrations. Additionally, some PID instruments are available with integrated electrochemical oxygen sensors that simultaneously monitor oxygen concentration in addition to flammable vapor concentration, providing an ideal confined space entry tool for aircraft fuel tank maintenance applications.

Monitoring the Atmosphere

Regardless of the technology employed, it is critical that maintenance personnel are thoroughly trained to monitor fuel tank atmospheric conditions. OSHA specifies three monitoring methods: initial testing, periodic testing, and continuous testing.

Initial testing begins from outside of the confined space using probes and/or sampling lines and proceeds into all areas to be occupied by personnel. Also, keep in mind that travel distances and obstacles can affect worker safety in an emergency situation.

Figure 3

A TYPICAL AIRLINE'S FUEL TANK ENTRY GUIDELINES

Contamination Level	Degree of Safety	Is Electrical Power Permitted?	Is Personnel Entry of Fuel Tank Permitted?
Tank atmosphere above 20% LEL	Unsafe	No	No
Tank atmosphere is less than 20% LEL but greater than 1,000 ppm	Fire unsafe	Yes	No
Tank atmosphere is less than 1,000 ppm and oxygen content is above 19.5%	Fire safe	Yes	Yes, with approved respirator
Tank atmosphere at less than 200 ppm and above 19.5% oxygen	Health safe	Yes	Yes

Periodic testing usually refers to re-evaluating the space:

- after workers return following a break or change in work shift;
- when there is a change in the exposure atmosphere; or
- when a new or a different operation begins.

Continuous testing means keeping the instruments activated for as long as aviation maintenance technicians are inside of the confined space. Through continuous monitoring, workers will be alerted immediately to any atmospheric changes in the confined space.

It is important to remember that, because of the differences in the vapor density of gases, testing must be performed at varying heights to ensure that full atmospheric evaluation is completed. For instance, some gases are heavier than air and tend to collect at the bottom of a confined space; others are lighter than air and are found usually in higher concentrations near the top of the space.

As a rule of thumb, test the space approximately every four feet in the direction of travel, and extending out to each side. Keep in mind that gases have a habit of "pocketing" when left undisturbed.

Even if workers follow these guidelines, however, they should be cautious when observing readings on atmospheric monitors. The instrument usually is set specifically to monitor for oxygen content, flammable concentrations, and several toxic gas concentrations. The monitor is specific to these readings. If there is a change in the oxygen readout, without a change in one of the other readings, it is a sign that there likely could be some condition present that is capable of displacing or changing the oxygen level.

Another necessary precaution is instrument calibration. Atmospheric monitors must have the calibration frequently checked—each day before testing a confined space is best—according to the manufacturers' specification.

While entry into airplane fuel tanks is necessary for inspection and maintenance, it clearly is a job that can pose significant personal health risks to untrained aviation maintenance technicians. Through effective worker education, proper training, and the correct use of manufacturer's maintenance manuals, safety equipment and instrumentation, the job of making the planes safer will be safer too.

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Aircraft Fuel Tanks

Regardless of the type of aircraft or the manner of maintenance performed within a fuel tank, each time one enters this confined space there is the potential for serious injury or death. Remember to always check the aircraft's maintenance manual for any recommended procedures.

The Occupational Safety and Health Administration (OSHA) has established guidelines for operating in a confined space (29 CFR Part 1910.146). According to OSHA, a confined space is an area large enough to bodily enter and perform work, has limited means of entry or exit, and is not designed for continuous human occupancy.

Additionally, OSHA requires permits be obtained before entering certain types of spaces. A permit-required confined space has one or more of the following characteristics:

- Contains, or has a known potential to contain, a hazardous atmosphere.
- Contains material with potential for engulfment.
- Has an internal configuration such that an entrant could be trapped or asphyxiated in inwardly converging walls or a floor that slopes and tapers to smaller sections.
- Contains any other recognized serious safety or health hazard.

OSHA's confined space standard requires employers to:

- Perform an initial evaluation of any new space before personnel entry.
- Establish a permit-required, confined-space program to regulate entry into spaces.

Confined-space entry training is an important factor in OSHA regulations and applies to all employees—including supervisors—required to enter a space with a restricted entry or exit and the potential of accumulating dangerous gases or reduced oxygen levels. OSHA regulation 1910.146 requires that all employees who enter restricted spaces receive training and information on the following topics:

- Expected duties of the attendant, authorized entrant and entry supervisor
- Contents, location, and availability of the organizationís confined space entry plan
- Contents, location, and availability of the department plan
- Atmospheric conditions
- Entry/exist access
- Engulfment conditions
- Specific confined space entry procedures
- Operating and rescue procedures
- Confined spaces entry permit forms and authorization
- Test equipment procedure and calibration/ maintenance schedule

Employees must be trained before their initial assignments into confined spaces, before a change in assigned duties, and before changes in operations or when deviations occur in procedures. OSHA permits the annual review of canceled permits and, although it does not require annual retraining, it is a good practice to follow.

Even though annual refresher training is not mandated, unless previous situations develop, it is a good safety practice. Records of confined space locations and testing results should be maintained for five years as part of the overall program. Canceled permits must be maintained for at least one year as part of the standard's requirement for ongoing review process.

While OSHA regulations clearly outline training required by law, keep in mind that these are minimum requirements. Always be aware of confined spaces to be entered and the operations going on in and around those spaces.

For more information and for a sample program, visit the OSHA Confined Space page at its Website <http://www.osha-slc.gov/SLTC/confinedspaces/index.html> . Or refer to the following publications:

- Permit-Required Confined Spaces, Final Rule; OSHA, 29 CFR Part 1910.146; Federal Register 63: 66018-66036, December 1, 1998.
- A Guide to Safety in Confined Spaces (NIOSH Publication Number 87-113), July 1987.
- Safety Requirements for Confined Spaces, American National Standards Institute, Z117.1-1989.

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= Confined Spaces

Preparation and Training are Keys for Aviation Maintenance Crew

The most important factor in preventing injury during fuel-tank work is a properly trained and equipped entry crew, composed of the entry supervisor, the standby attendant, and entry personnel. Each member of the team must be trained in:

- Continuous voice communications practices
- Safety equipment usage (including head, eye, ear, body, and respiratory protection)
- Ventilation and air monitoring techniques
- Use of intrinsically safe power tools and equipment, lighting, etc. (e.g., pneumatic tools must be powered by compressed air only, not by nitrogen or other inert gas, which could displace the oxygen inside the fuel tank)
- Emergency response plans (including entrant self-evacuation, attendant-ordered evacuation and unresponsive tank-entrant rescue)

Thorough evacuation and rescue procedure training is particularly important, the National Institute for Occupational Safety and Health (NIOSH) reports that more than 60 percent of all confined space fatalities occur among would-be rescuers.

The maintenance crew must take a number of steps to prepare the fuel tanks for entry:

- Reading the aircraftís maintenance manual for any manufacturer's recommended procedures
- Electrically ground and defuel the airplane
- Prepare fire protection equipment
- Deactivate associated airplane systems, including fueling/defueling and fuel transfer systems
- Ensure adequate ventilation before and during maintenance operations

Vent the Space

Properly venting the space [according to the manufacturer's maintenance manual] is the single most important method of controlling fire, explosion and toxic hazards associated with working inside jet fuel tanks. The more fresh air present in the fuel tank, the safer the environment will be for maintenance personnel.

Continuously pushing fresh air into a fuel tank helps reduce the chance of fire and explosion by preventing a fuel vapor concentration from reaching its lower flammability limit (LFL). Fresh air also helps dilute toxic chemical and concentration and reduces the risk of VOC exposure and oxygen deficiency.

One practice recommended for conducting tank ventilation is the push-pull technique. First, open an upstream "push" access hole. Next, open a downstream "pull" hole. Then locate a blower at the push hole to force fresh air into the tank. Exhaust equipment can be located at the pull hole to supplement tank airflow.

There are, however, several challenges to venting airplane fuel tanks. The physical structure of some tanks can create dead air spaces and small openings between tank sections can inhibit airflow. Also, ventilation equipment must be selected and set up properly to prevent interruptions of ventilation operations before work is completed. Planning and execution are critical to providing adequate ventilation.

Once the fuel tank is ventilated adequately, and the confined space's oxygen, flammability, and toxic vapor levels have been tested and found to be in the acceptable range, a confined space permit may be completed and posted at the space's entrance. Only then should maintenance personnel enter the space.

Lifestyle Choices

Routine lifestyle choices can reduce performance and increase susceptibility to diseases

by Stanley R. Mohler, M.D.

Too much of one kind of food consumed during a single day can adversely affect a flight crew or cabin crewmember's duty performance, especially if fatigue or sleepiness is induced. Too little food or an irregular schedule of food intake can also increase irritability and decrease endurance. In addition, dietary habits are linked to heart disease, stroke, high blood pressure, cancer, and dental diseases. Moreover, poor choices can result in health problems that may end crewmembers' careers, their good health, and even their lives.

Individuals vary in their digesting and processing of food. Some people, for example, through rapid metabolism, tolerate very high intakes of carbohydrates. Others process fat efficiently. Still others gain weight after eating too many carbohydrates or fats.

Food is often a source of considerable pleasure and is a reflection of our social fabric and cultural heritage. Yet what we eat also affects our short- and long-term well-being. Many cultural influences determine what foods are available and are chosen for consumption. Home and work environments may include extremes of cold, hot, humid, or dry conditions. Climate often plays a major role in determining what kinds of foods are available.

The senses of taste, smell, sight, and touch play a significant role in the daily dietary cycle. The influence of the senses on the enjoyment of eating is directly related to an individual's expectations based on childhood experiences, cultural influences, and personal physical characteristics.

Taste expectations for food are essentially the result of a learned process. Everyone has had the experience of eating an unfamiliar food and initially finding it unpleasant. The same experience is true of the sense of smell. At first, the smells of some cheeses are unappealing to many people.

In addition, there are expectations about a food's shape and color, and any variation can produce a negative or cautious response. Food texture is also very important. An apple should have a certain resistance that makes biting into it very different from biting into a banana.

Healthy eating habits are described at length in a report by the U.S. Surgeon General. The report recommends that people:

- Eat a variety of foods
- Maintain a desirable weight
- Avoid too much fat, saturated fat [more-solid fat such as that in butter, bacon, beef, and pork], and cholesterol
- Eat foods with adequate starch and fiber
- Avoid eating too much sugar
- Avoid eating too much sodium (including salt)
- Drink alcohol in moderation, if at all.

Among the most important considerations in choosing an optimum diet are the following:

Cholesterol

Cholesterol is a fatty substance that is linked to the clogging of arteries, especially the arteries of the heart. The name cholesterol is derived from the substance's high concentration in bile ("chol"), its tendency to separate from other blood components ("ster" - solid), and its chemical makeup of an alcohol nature ("ol"). [Alcohol is a family of organic compounds that contain the atomic group OH (oxygen hydrogen) in conjunction with a chain of carbon atoms.]

Cholesterol in the diet is metabolized by the liver. For people who inherit a relatively low number of cholesterol receptors in the liver, a diet high in cholesterol will result in longer circulation times of ingested cholesterol, because less cholesterol will be extracted from the blood on each pass through the liver. This will, over the long term, harm arterial health, as cholesterol deposits accumulate on arterial walls and begin to block blood flow.

The U.S. Surgeon General explains, "Intervention to lower elevated blood cholesterol levels has been shown in both human and animal studies to reduce coronary heart disease risk...The first line of intervention is diet therapy." To help reduce cholesterol levels, people should eat foods, such as vegetables, fruits, whole-grain foods, fish, poultry, lean meats, and low-fat dairy products that are relatively low in fatty substances. A simple rule of thumb is that cholesterol is found only in animal products (including dairy products)—not fruits and vegetables.

High Fat Intake Increases Health Risk

The U.S. report says that "high intake of total dietary fat is associated with increased risk for obesity, some types of cancer, and possibly gallbladder disease...Dietary fat contributes more than twice as many calories as equal quantities (by weight) of either protein or carbohydrates..."

Types of fats include free fatty acids, glycerols [a form of alcohol that the body produces from the dietary fats], cholesterol, and the large fat molecules in butter and margarine. Fats are stored in body tissues if the daily caloric intake, especially fat intake, exceeds daily caloric output. Fats yield nine kcalories per gram when metabolized. [A kcalorie is 1,000 calories. A calorie is the amount of heat energy necessary to raise the temperature of one gram of water by one degree C (1.8 degrees F), starting from 14.5 degrees C (58 degrees F), with pressure constant.] The amount of exercise determines whether excess fat is stored or burned during exertion.

Fats tend to remain in the stomach longer, resulting in a longer period of satisfaction after a meal; hence, the pleasure some people experience after consuming large amounts of fatty meats, butter, and other foods high in fat content.

Using food preparation methods that add little or no fat is another way to control consumption of fats. If a person has difficulty metabolizing cholesterol, dietary cholesterol should be restricted. Medical supervision is often advisable in managing dietary restrictions.

Digestion

Long-term intake of specific foods will influence short-term digestive capabilities. An abrupt change in diet might result in temporary discomfort immediately following eating.

To reduce the likelihood of digestive upset, a crewmember should be prepared for the dietary differences that might be encountered in different national regions and in other countries. Dry-packaged foods can be carried on flights that do not require long crew layovers, and fellow crewmembers may know where familiar food can be found. In addition, crewmembers can experience a variety of foods before the trip—usually in local restaurants—and focus on foods that may be expected during future layovers.

Nutrients

Carbohydrates are the quick energy substances of the diet. When metabolized, they yield four kcalories (4,000 calories) per gram. A large, physically active young man may require 4,000 kcalories of energy per day.

Proteins give structure to the body. When metabolized, proteins yield four kcalories per gram. Proteins also stimulate "specific dynamic action," a process in which measurable heat is produced when protein is metabolized. The preference of those in very cold climates for diets high in protein and of those in hot climates for diets high in carbohydrates is attributed partly to the different processing mechanisms for these substances and their differing effects on the body.

Difficulty in processing some nutrients can cause serious health problems. Diabetes, for example, affects approximately five percent to eight percent of the U.S. population. People who require insulin injections to properly metabolize glucose—the form of sugar that the body uses for its metabolism—are defined as having insulin-dependent diabetes mellitus (Type I diabetes). Those who have difficulty processing glucose, but can control their diabetes with dietary restrictions, are defined as having noninsulin dependent diabetes mellitus (Type II diabetes). Diabetes can affect flight crew status.

If an individual processes glucose slowly (noninsulin-dependent diabetes mellitus), sugar intake should be restricted. Controlling obesity by reducing dietary fat intake can also help control Type II diabetes. This guideline is consistent with dietary recommendations for the prevention of coronary heart disease, hypertension (high blood pressure), and some types of cancer.

Through screening programs, crews should learn about their metabolic characteristics, such as blood glucose, blood lipids (including the high- and low-density forms of cholesterol), and other blood elements. Body fat content should also be estimated. A target body weight can guide food intake and exercise practices.

Although a general knowledge of

Table 1
Obesity as Measured by Body Mass Index

Body Mass Index

Classification	Men	Women
Severely Obese	>31	>32
Moderately Obese	28-31	27-32
Normal	24-27	23-26
Underweight	<24	<23

Body mass index (BMI) = Weight in kg ÷ height in m^2

good nutrition principles is useful, it does not fully enable a crewmember to decide on a specific diet or rate the nutritional quality of particular food items. For day-to-day guidance, various books provide guidance for optimizing consumption of proteins, carbohydrates, fiber, vitamins, and minerals.

For example, one book describes a system that scores foods for their nutritive value and lists the number of points for particular foods within the categories of vegetable, fruit, grain, legume, milk/dairy, and meat/poultry/fish. It even gives separate scores for different brands of the same type of food in some cases. The system also considers food from the view point of caloric intake and suggests that an average of about 100 points a day will provide enough calories to be satisfying, while avoiding extremes of caloric ingestion that could cause weight gain or loss.

Exercise Complements Good Nutrition

Exercise

Optimum health is achieved with good nutrition and exercise. The 206 bones of the human body are actuated by more than 600 muscles. The bones provide support against gravity, and the muscles derive their energy from ingested food. For these and other reasons, a lifestyle that includes regular exercise is necessary for robust health, thereby enhancing individual performance. Each crewmember should determine a long-term diet and exercise program that is best for him or her and stick to it. Then use discipline—and no excuses—to follow the program.

Calcium retention is another benefit provided by exercise. When a muscle contracts against a bone, the bone retains calcium. With insufficient forces on them (lack of exercise), bones release calcium into the blood, after which it is excreted in the urine. This can ultimately result in loss of bone density, a condition known as osteoporosis. Weight-bearing exercise increases both muscle endurance and size.

Sensible exercise also improves circulatory efficiency and cardiovascular conditioning. A well-conditioned heart muscle can provide continuing support for the muscles of the body and meet organ demands for circulating blood. Endurance during long duty periods will also be improved.

Weight

Some scientific evidence suggests that obesity can be linked to genetic factors, but dietary patterns, caloric intake, and energy expenditure play key roles. Long-term efforts to reduce body weight can be achieved best by proper diet and exercise.

The U.S. report presented a quick method to determine if one is chronically overnourished. The method involves measuring the body mass index (BMI) to determine relative obesity.

To calculate BMI, divide body weight in kilograms (one kilogram = 2.2 pounds) by height squared in meters (2.54 centimeters = one inch; 100 centimeters = one meter). (See Table 1 on page 17)

Monitoring BMI gives a crewmember quantitative information on the physical effects of lifestyle and nutrition changes. Crewmembers should monitor their BMI to guard against undesired weight gain. Nevertheless, BMI only provides guidelines, which represent average U.S. adult ranges.

Medical knowledge of the complex relationship between diet and health continues to evolve. Crewmembers should keep themselves informed about developments relating to health and performance.

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Example 1

Male: 200 lb. = (200 ÷ 2.2) = 90.9 kg

71 in. = (71 x 2.54 = 180.3 cm) = 1.8 m = 3.24 m^2

BMI = 90.9 ÷ 3.24 = 28.1

(This man has heavy bone and muscle structure; therefore, a tolerance of one or two points is allowable. The man can be considered within the normal range.)

Example 2

Male: 179 lb. = (179 ÷ 2.2) = 81.4 kg

69 in. =(69 x 2.54 = 175.26 cm) = 1.75 m = 3.06 m^2

BMI = 81.4 ÷ 3.06 = 26.6

Example 3

Female: 160 lb. = (160 ÷ 2.2) = 72.7 kg

67 in. =(67 x 2.54 = 170.18 cm) = 1.70 m = 2.89 m^2

BMI = 72.7 ÷ 2.89 = 25.2

kg= kilogram (lkg=2.2 pounds) m =meter (1m =3.28feet)
cm = centimeter lb. = pound in. = inch

Source: U.S. Department of Health and Human Services/U.S. Surgeon General

SURFACE TENSION Part 1

SOP's for Towered Airport Surface Operations

by Phyllis Anne Duncan

This past summer I was assigned to a special project and flew to Kansas City, MO, every other week. Like most large, city airports in the country MCI is undergoing construction. Large sections of its ramps are blocked off for that construction, and taxiways which were open one week were closed off two weeks later. Makes keeping the airport diagrams up to date a nightmare. It also poses a bigger threat—that of conflicting surface operations or, in layman's terms, a runway incursion.

Runway incursions have been in the news a great deal lately, with the impression that airplanes are scraping wingtips every other minute. Of course, that's not true, but as with any operation of an aircraft on the ground or in the air, there is still a concern for the potential of accidents. Runway incursions are accidents waiting to happen, and the FAA has been emphasizing education and training for all aspects of aviation in how to prevent them. The best adage, of course, is not to get yourself in a situation from which a runway incursion results—sort of the "defensive taxiing" approach. This requires a great deal of multi-tasking in a cockpit which may already be busy, particularly during single-pilot operations, but, when you pare all the possibilities down into something like standard operating procedures, adding runway incursion prevention to the cockpit workload isn't so egregious as it sounds.

The old highway safety adage was that an automobile accident is more likely to occur when you are within 25 miles of your house. Statistics show that aircraft accidents occur on takeoff/climbout or approach/landing. Taxiing to, onto, and from the runway may seem to be the safest portion of a flight operation, but there have never been any formal procedures for getting from the parking spot or the gate to the runway, other than what ground control tells you to do or habit indicates for a non-towered airport. With the nationwide construction mentioned earlier, increased traffic, and busier airports, operating safely on an airport surface is becoming a challenge to the broad spectrum of pilots.

To alleviate this "surface tension," FAA has developed some safe operating procedures we feel will reduce exposure to hazard and overall risk during airport surface operations. In this article, Part 1, we will deal with operations at towered airports, and Part 2 in the next issue will deal with non-towered airports. Of course, adding more procedures to the workload of a pre-takeoff or pre-landing cockpit may seem a contradiction. More and more today pilots are programming flight management systems, dealing with complicated air traffic control instructions, receiving data link messages, or talking to the company for last minute dispatch information. If the procedures we suggest are formalized and included in pilot training, they become a part of the routine, increasing pilot awareness without increasing the workload.

Reducing runway incursions really comes down to three adequacies: planning, coordination, and communication. All have to be complete and thorough to assure that runway incursions do not become a common part of surface movement. The challenges between a cockpit crew of two or three versus a crew of one are different, and any safe operating procedures have to take that into consideration. After careful study of runway incursions over the past year, FAA has found that the suggested guidelines developed by Flight Standards' General Aviation and Commercial Division and the Air Transportation Division fall into six major categories: Situational Awareness, Planning, Use of Written Taxi Instructions, Intra-cockpit Verbal Communication, ATC/Pilot Communication, and Taxiing.

Situational Awareness

Telling a pilot to be aware of the situation around him or her may seem simplistic, but a lack of situational awareness is often the cause of a runway incursion—turning on the wrong taxiway, crossing a runway you were told to hold short of, etc. To prevent this you have to know the position of your aircraft on the airport's surface at all times. At your local airports to which you travel frequently, the airport diagram might be like a moving map display inside your head, but put you at a wholly unfamiliar airport, especially one where the runway/taxiway layout is complex and/or the visibility is poor, and situational awareness may seem impossible to attain. Consequently, you have to do what you can to establish and maintain that situational awareness, using everything available on the airport and in your cockpit. Again, you have to "see" in your head, or visualize, your movement on the airport—a continuous loop process where you actively monitor and update your position. Simply put, this is knowing your starting point then mentally projecting your next position progressively through every twist and turn until you reach the runway. Of course, this requires a beginning frame of reference, and a printed airport diagram is an ideal one.

When in a multiple-person cockpit, you can at least tell each other where you are, but being alone in a cockpit doesn't mean you have to keep your mouth shut. So what if you tell yourself out loud, "Now turning on taxiway Charlie, heading to Delta?" Unless you have a stuck mike, who's going to know? The more senses you use, the more reliable the information you take in, so if you speak and hear yourself doing it while double-checking your location on a printed airport diagram, you've just employed three senses in preventing a runway incursion.

Here are some safe operating procedures designed to enhance your situational awareness:

1. Monitor ATC instructions or clearances issued to other aircraft
2. Scan the full length of a runway, including its approach areas, before entering it or crossing it. When you have more than one pilot crewmember, verbally confirm a clear scan.
3. At night or during reduced visibility, be even more vigilant after receiving a "position and hold" clearance. Don't remain sitting on a runway for a long time awaiting your takeoff clearance. How long is a "long time?" About the time you start to feel as if you have a large target on your back, which should be the time you roll onto the runway. If you don't hear from ATC, call them. If they don't answer, assume you have a radio problem and look for light gun signals from the tower.
4. Again, during times of reduced visibility, if you're using a runway for a taxiway, be alert and expedite the time spent on that runway. Remember, any runway without an X on it, could be an active one.
5. If you've landed on a runway and your taxiway turnoff very quickly intersects with another runway, be especially cautious. Air traffic will have issued instructions whether or not to cross that second runway, so make certain all other crewmembers heard it, too. If there is uncertainty, call ATC. When you do have to hold short of a parallel runway or one in proximity to your landing runway, make certain you are completely clear of both runways. Again, if you're not certain, query ATC, who is in the best position to check that out and tell you.
6. Like the sterile cockpit rule below 10,000 feet, keep all nonessential communications and crew actions to a minimum until you are clear of all runways.

Planning

We are all accustomed to planning our flights, even filing a flight plan. To date, for most of us, planning our taxi routes and procedures has not been a part of the flight plan. Planning taxi operations could be a natural extension of other operational planning, and, in fact, taxi planning should get just as much attention, especially at large, busy, or unfamiliar airports. Safe operating procedures for taxiing can be grouped into two areas: *pre-taxiing planning* using previous knowledge of the airport, ATIS, and/or an airport diagram; and after receiving taxiing instructions from ATC, when your *"taxi plan" should be updated and reviewed.* In either case, if you have another cockpit crewmember, review the plan with him or her, and if alone, again, have a plan and review it with yourself.

1. Take the following into consideration during your *pre-taxi planning and briefing*:
   - How familiar are you or your crew with this airport?
   - Have you flown in or out of it recently?
   - Have changes been made since your last flight?
   - Did you review NOTAM's for this airport, as well as your arrival airport, to be aware of any construction or surface closures?
   - Study the airport layout. If there are other crew and you're the PIC, see that they get copies, too. Check the taxi route you expect to get (i.e., from observing other aircraft movements, ATIS, etc.) against the airport diagram. Note the "tricky" intersections. If you're taxiing out, anticipate the direction other aircraft will be using to taxi in. Point out the critical locations on the possible route—those complex intersections, crossing runways, entering the runway, and lining up on the runway. Make certain the rest of the crew is aware of those locations and intervals.
   - With a multiple pilot crew, consider planning your checklists and company communications so that at least one pilot is free to confirm compliance with ATC instructions. When visibility is low, consider conducting predeparture checklists when the aircraft is not under movement.
2. Once you *receive your taxiing instructions from ATC*, use the following guidelines, bearing in mind that in multiple pilot crews, good communications among crewmembers is vital.
   - Write down the taxi instructions received from ATC. Use shorthand—as long as you can remember it—and note only the basic elements of the taxi clearance: starting point, ending point, crossing intervening taxiways or runways, hold short instructions. Consider taking the instructions down word for word if the airport has a complex layout or if you are unfamiliar with it. Because airport surface operations are now so busy and intricate, trusting your memory of taxi instructions in the midst of other cockpit duties is probably not a good idea.
   - When in doubt about what you've written down, i.e., if it doesn't make sense against the printed diagram or your last operation there, ask ATC for clarification
   - Use the written instructions as a reference when you read-back to ATC, for crewmember coordination, for a short crewmember briefing on the instructions, and as a means of reconfirming the taxi route and any restrictions. The latter helps to eliminate any repeat calls to ATC for clarification, something for which they'll be eternally grateful.

Since we've brought up written taxi instructions here, let's digress for just a moment and talk about when they're needed and when they aren't. If your departure runway is close to your gate or parking location or if you've used this route many, many times and are familiar with the airport, you may need only to jot down the basics, or you may not need to write them down at all. You will have to be the best judge of that, based on your experience and familiarity with the airport. Consider, however, that if you write down what you've heard and double-check it against an airport diagram, you'll have a nearly infallible reference as you move along the runway surface.

Once you receive ATC's taxi instructions, compare it to the route you planned or anticipated and update your plan with yourself and any other crewmembers. Don't get too locked into your planned or anticipated route, because setting that firmly in mind can create false expectations. However, the exercise of planning a route is an important one, because it gets you thinking "situationally." Then, follow, however, the clearance issued by ATC.

Intra-Cockpit Verbal Coordination

Singing off the same sheet of music, rowing in the same direction, using the same checklist are all cliches about coordination. Without crew coordination in your cockpit, you run the risk of your communications resembling the old Abbott and Costello skit, "Who's on First?" ("I don't know." "Third Base.") Verbal coordination in the cockpit is crucial to "singing off the same sheet of music" as far as taxi instructions are concerned. All crewmembers should be satisfied that they all understand the instructions before the aircraft begins movement. One crewmember can read the instructions to the others then get agreement on the content and the intent of the instructions—that concurrence should be verbal, not head nods. The verbal coordination should consist of:

1. The PIC and SIC referring to the airport diagram upon receipt of ATC's instructions then agreeing (verbally) on the assigned runway and taxi route, including any hold short or runway crossing instructions.
2. The PIC and SIC agreeing (verbally) on the landing runway as instructed by ATC, including any restrictions, i.e., holding short of another runway, etc.
3. The PIC and SIC, after landing and exiting the runway, agreeing on the ATC taxi instructions to the parking area or gate, including any instructions to hold short of or cross a runway.
4. All flight crewmembers verbally coordinating to identify the correct taxiway at complex intersections so that the aircraft gets through that intersection to the correct taxiway.
5. All flight crewmembers verbally coordinating to identify the runway when approaching an intersection runway and to review the ATC instructions as to whether they are to hold short of or cross that runway.
6. Both pilots visually scanning (left and right) before crossing any runway or taking the runway for takeoff to assure that the full length of the runway and its approach paths are clear or not. The report that the runway is or isn't clear should be verbal.
7. All flight crewmembers, before entering a runway for takeoff, verbally coordinating to assure that it is the runway you've been cleared to use and that clearance has been received to use it. The same should be done when approaching to land.
8. Any crewmember who has to stop monitoring ATC should tell the other crewmembers when the monitoring stops and when it starts again. If another crewmember receives instructions during that interval, that information needs to be briefed and reviewed by all flight crewmembers.
9. A pilot who is not taxiing and is "heads down" for whatever reason—entering information in the flight management system, for example—and cannot visually monitor the aircraft's progress must verbally advise the pilot taxiing. Once that pilot goes "heads up" again, that information should be shared as well.

This may sound as if you're going to have one chatty cockpit, but information is power. In this case, it's a tool which can help prevent a runway incursion, so don't worry about talking too much, as long as the talk is focused on business.

ATC/Pilot Communication

Speech is not only one of the most vivid and information-rich forms of communication, it is also, unfortunately, one that provides the most "miscommunication." Quite often, the miscommunication is a result of hearing what you expect to hear and not what was actually said. This has led to countless domestic disputes, even the occasional war, but its accident potential is most apparent in pilot/controller communications. The dichotomy is that voice communications can also be one of the most effective means of eliminating runway incursions.

Communication between a pilot and controller is a two-way "loop" of instructions, acknowledgement, query, clarification, and so on. To keep the messages and information in this loop clear and precise, pilots and controllers need to use appropriate phraseology. This helps to eliminate miscommunication and allows everyone to understand what the other is communicating. To work as prescribed, proper phraseology must be two-way: Controllers providing clearances and instructions with proper phraseology and pilots reading back and asking for instructions or clarification in proper parlance. The *Aeronautical Information Manual* (Chapter 4, Section 2, Radio Communications Phraseology and Techniques) contains a good primer on proper phraseology; however, the following guidelines will also contribute to clear and accurate communications:

- Maintain a "sterile" cockpit on the ground. Eliminate the nonessential chatter, not eating, or not reading non-flight related material while taxiing allows the crew to focus on their duties. In aircraft where the passengers have access to the crew (i.e., no cockpit door to close), pilots need to explain to their passengers the need for not engaging in non-flight related conversations while taxiing to and from a runway.
- Use standard phraseology at all times.
- Focus on what ATC is saying, and don't perform any nonessential tasks while communicating with ATC.
- Read back all hold short and runway crossing instructions, including the runway number.
- Clarify any misunderstandings among the crew about ATC instructions or clearances. Don't continue movement until everyone is satisfied that they understand.

Taxiing

No, we're not going to review how to taxi an aircraft but, rather, suggest some good practices for when you have to conduct certain cockpit duties and steer, maneuver, and change speed while taxiing to and from the runway. Again, study and investigation of runway incursions have shown that attention to duties inside the cockpit often led to a neglect of good taxi technique or a simple failure to follow directions.

1. Before taxiing the aircraft, all pilots should have a copy of the airport diagram. In a single-pilot operation, there is no one to check that you're following ATC instructions, but the airport diagram will help you confirm that you're going the way ATC expects. In a multiple pilot crew, one crewmember—one other than the pilot taxiing—can follow the aircraft's progress against the diagram.
2. Use the aircraft's compass or heading indicator as a supplement to your visual orientation. It also helps you confirm taxiway or runway orientation. Again, this may seem a bit simplistic, but, before you get defensive, there have been incidents where pilots indicated they never thought to use the compass or the heading indicator as an aid on the ground. At complex intersections and where the takeoff ends of two runways are in proximity, these two, simple visual aids can give you a glimpse at the bigger picture.
3. At large airports reporting visibility in runway visual range (RVR), low visibility is considered anything below 1200 RVR—that's for the runway itself. Visibility on ramps and taxiways may be considerably less. Use all the assistance the crew, the aircraft, and the airport itself provides: non-taxiing pilots keeping a careful watch out, checking the heading indicator, carefully reading the airport signage, markings, and lighting, and using the airport diagram. Oh, and don't forget—slow down. Makes the interpretation of visual information easier.
4. Check with ATC any time you are uncertain of your position on the airport—stop the aircraft if you have to, except NEVER stop on a runway. do Not exit onto another runway after landing, unless you have been cleared to do so. Ask for progressive taxiing instructions.
5. Expedite your takeoff, crossing a runway, or exiting a runway when instructed by ATC. If something is going to delay any of those actions, inform ATC immediately.
6. Last but not least and again, not to be simplistic, DO NOT exit onto another runway after landing unless you have been cleared to do so.

Summary

Some of the things outlined in this article, many pilots do instinctively or after many years of experience. What we hope to do is "formalize" them by putting them in print. They have been proven to increase safety during airport surface movement, and hopefully with widespread use, they will eliminate "surface tension" and reduce runway incursions. For your future use, these guidelines are summarized on the next page in somewhat of a checklist format.

In Part 2 of this article, next issue, we'll apply these guidelines to operations at non-towered airports. Yes, the dangers of runway incursions happen there, too.

Private pilots now have a free resource that helps in surface navigation—AOPA's Flight Safety Foundation website at <http//www.aopa.org/asf/taxi/>. And the FAA's Runway Safety Program has a section on its website that airport managers can use to post information about their facilities <http://www.faa.gov/runwaysafety/>.

AIRPORT SURFACE MOVEMENT CHECKLIST

Before Taxi

- ❑ Plan and brief airport surface operations.
- ❑ Check NOTAM's.
- ❑ Airport diagram available for all crewmembers.
- ❑ Airport diagram used in taxi plan
- ❑ Taxi instructions from ATC written down.
- ❑ All crewmembers AGREE on what is expected or seek clarification.

Taxi for Departure

- ❑ Monitor progress using airport diagram.
- ❑ Use compass or heading display to confirm taxiway/runway alignment.
- ❑ Eliminate nonessential cockpit activities.
- ❑ STOP the aircraft when uncertain of location and advise ATC. DO NOT stop on a runway.
- ❑ Request progressive taxiing instructions, if necessary.
- ❑ Monitor ATC communications with other aircraft.
- ❑ Use standard phraseology with ATC.
- ❑ All runway crossing and hold short instructions read back
- ❑ Confirm with self or crew or with ATC if uncertain of clearance before entering or crossing a runway.
- ❑ Scan full length of runway and approach paths before entering.
- ❑ Coordinate verbally with crew all runway crossing clearances, hold short instructions, and other critical items.
- ❑ Be more vigilant during periods of low visibility, especially when taxiing on or crossing runways.

Taking the Runway

- ❑ Read back all clearances, including to position and hold, using the runway number.
- ❑ Scan again the full length of the runway, including approach areas.
- ❑ Confirm with self or crew that clearance to take the runway has been given.
- ❑ Use the compass or heading display to confirm correct runway.
- ❑ Be more vigilant in periods of reduced visibility, especially for a taxi into position and hold clearance.
- ❑ DO NOT remain in "position and hold" for extended periods of time.
- ❑ Contact ATC or
- ❑ Look for light gun signals.
- ❑ Use exterior lights to enhance aircraft visibility.

Before Initial Descent

- ❑ Plan and brief airport surface operations.
- ❑ Airport diagram available to all crewmembers.
- ❑ Airport diagram used to plan expected taxi route.

Exiting the Runway

- ❑ Coordinate with crew for agreement on assigned runway and any restrictions.
- ❑ Runway cleared expeditiously or ATC notified of delay.
- ❑ Nonessential communication among crew eliminated until clear of all runways.
- ❑ Coordinate verbally on taxi instructions with crew. Single pilots mentally review ATC taxi instructions. Either case, clarification requested if necessary.

Taxi In

- ❑ Taxi instructions written down.
- ❑ Seek clarification from ATC if necessary.
- ❑ All crewmembers AGREE on taxi instructions.
- ❑ Airport diagram used to monitor progress.
- ❑ Compass or heading display used to confirm position.
- ❑ No nonessential communications until clear of all intersections.
- ❑ STOP aircraft if uncertain of position and advise ATC. DO NOT stop on runway. Request progressive taxi instructions if necessary.
- ❑ ATC communication with other aircraft monitored.
- ❑ Standard phraseology used.
- ❑ Hold short and runway crossing instructions read back.
- ❑ Confirm with self or crew or with ATC if uncertain of clearance before entering or crossing a runway.
- ❑ Scan full length of runway and approach paths before entering or crossing.
- ❑ Coordinate verbally with crew all runway crossing clearances, hold short instructions, and other critical items.
- ❑ Be more vigilant during periods of low visibility, especially when taxiing on or crossing runways.

The C-5 Lesson: A Near-Fatal Takeoff Tale

A new FAA Advisory Circular (AC), Developing and Implementing Standardized Pilot Procedures for Airport Surface Operations, is being drafted that outlines ways to help reduce runway incursions. A coordinated project between Flight Standards Service's Air Transportation Division and the General Aviation and Commercial Division, the AC, when it is released, will detail effective techniques to reduce the risk of a runway incursion for both multi-crewed aircraft and single-pilot aircraft.

The need for such an AC was highlighted in the Naval Safety Center's aviation magazine, *Approach*, June 2000 article titled "Don't Worry About That C-5 in Front—They Must Be Circling To Land." It reported that a control tower at a foreign airfield had cleared the U.S. Navy aircraft to taxi into position and hold on the runway. While waiting for release, the flight crew was monitoring the field's approach and departure frequency on the aircraft's number two radio. Therefore, the flight crew knew that an Air Force C-5 aircraft was maneuvering to land. The crew assumed the C-5 was going to circle to land behind the Navy aircraft based upon the wind condition and the fact the tower had taxied the Naval aircraft into position and hold. Cleared for takeoff, they began their near-fatal takeoff roll.

"At approximately 90 knots with 5,500 feet of runway remaining, I watched the C-5, then three to four miles in front of us, continue its descent for landing. Realizing the imminent danger, I initiated an abort. Concurrently, the tower told us to 'Abort takeoff.' Also, the approach-departure controller directed the C-5, now on short final to 'execute missed approach.'"

A later investigation discovered the approach-controller had cleared the C-5 to land on the same runway without tower authorization while that same approach-control had authorized the tower controller to clear the waiting Navy aircraft for takeoff on the same runway. Unfortunately, the aircraft were each heading in a different direction. According to the article, an Air Traffic Control review board found the approach-controller at fault and suspended him indefinitely.

The "Anonymous" Navy pilot, who submitted the lessons learned article, said in part that "this entire incident could have been avoided if I, or another flight station crew member, had insisted on clarifying the C-5's intentions. It would have only taken a second to query the tower controller before ever taking the runway. It was a tough, embarrassing lesson for everyone, especially me."

If you think this type of incident only happens to U.S. military pilots at foreign airfields, think again. This incident is just one of many similar incidents that have happened across the United States. In some cases, aircraft have been cleared to land on runways with other aircraft holding for takeoff in some cases with fatal results.

Air carrier and military aircraft are not the only aircraft at risk. As this magazine has reported in a recent issue, general aviation aircraft have had their share of accidents and incidents on or near airports. From one GA aircraft landing on top of another on final approach to incidents involving aircraft on the surface, the risk of an accident or incident is real for all types of aircraft.

The AC, which is in the final stages of production, outlines many of the lessons learned from past accidents or incidents that will help flight deck crews avoid each other.

Suggested techniques include minimizing pilot workload when receiving and copying complex taxi instructions. The benefits of writing down detailed taxi clearances. The advantages of having copies of airport surface diagrams. The critical importance of always having situational awareness and knowing exactly were you are at all times on the airport surface. The need to ensure that your aircraft can safely cross a taxiway or runway. Equally important is the need to ensure your aircraft has completely cleared a runway or taxiway once cleared to cross. The importance of always scanning both ends of a taxiway or runway to make sure no other aircraft is entering it or taking off or landing on it. The critical issue as outlined in the Navy article of always asking air traffic for clarification of any situation that does not seem right. As the Navy pilot said, it would have only taken a second to ask the tower about the C-5 aircraft approaching them head-on. The advantages of multi-crewed aircraft to have a definite procedure for coordinating their workload and surface responsibilities while taxiing, taking off or landing cannot be overlooked. In addition, the importance of a sterile cockpit environment is equally as important in both multi-crew aircraft as well as in the single-pilot aircraft environment.

Moreover, as the Navy article points out very clearly, operating on a field with air traffic service does not provide 100 percent protection. Controllers can make mistakes as well as pilots. Either type of mistake can be deadly. Pilots at non-towered airports need to be especially alert for unexpected actions by other pilots. As outlined in the proposed AC, all pilots must monitor the appropriate ATC frequency and follow good communication's techniques as outlined in the most recent version of the *Aeronautical Information Manual* (AIM). The same is true of the recommended operating procedures at all types of airports.

Safe Flying. ✈

• "MID-AIR"

I just finished reading the article "MID-AIR" in the July/August issue and found it quite interesting. I attend every safety seminar put on by our FSDO (Albany, NY) as possible. At two of these seminars, a program they titled "Operating VFR in an IFR Environment" was presented. A CFII from a locally prominent flight school superimposed some of the common instrument approaches to area airports on the sectional charts for the area. It was quite enlightening to me to see just where some of these routes are.

As a VFR pilot, I had no idea where to look when I would hear someone announce that they were on the "VOR Alpha Approach to Saratoga County," but I do now.

I would encourage all student and non-instrument pilots to query a local flight instructor about where exactly the instrument approach routes in their area are, and if possible, to sketch them on a sectional chart. I have been fortunate to never have had a close call, but having this additional information gives me a better idea where to scan when in the vicinity of some of our local airports!

William A. Waller
Clifton Park, NY
Via the Internet

You brought up an important point. Ok, flight instructors and FBO's, Mr. Waller has pointed out an important safety idea for all of you to develop into a safety issue with your students and VFR-only rental pilots. Maybe a local sectional chart or terminal control area chart with the various instrument approaches noted might be mounted on a wall or put up in the pilot briefing area. Pages from the local instrument approach charts or en route chart might also help.

A related issue was brought up at an aviation meeting recently involving an aircraft on an instrument approach into an airport when the control tower was closed. The aircraft had a conflict with an aircraft approaching to land on the opposite end of the same runway. The one aircraft could hear the other, but the aircraft flying the ILS could not hear the approaching aircraft. The wind favored the runway end being used by the non-instrument landing aircraft. The issue involves right away rules, which aircraft determines landing runway usage at a non-towered or at a closed-towered airport, and the risks of flying any type of instrument approach into an airport during VFR conditions. This actual conflict is a good reason for pilots to use ATC flight following when available or to monitor local approach control or departure control if available in your area.

• A Weighty Comment

Kudos to Glenn R. Stoutt, Jr., M.D. for his article "The Epidemic of Obesity" in the May/June 2000 *Aviation News* and for telling it like it is. In a time when much of the world's population is trying to obtain enough to eat, the food indulgence of Americans is a particularly painful image.

Individually we suffer with a greatly impaired quality of life physically and psychologically. As Dr. Stoutt states, we often look to weight reduction methods questionable in their scientific bases because they offer success without deprivation of desired lifestyle or foods.

The public all too eagerly pays for the promise of quick and easy diet solutions while the authors chuckle with each cha-ching of the cash register. Over consumption of any food (energy/calorie intake) above that needed to meet requirements (total energy expenditure) leads to fat production with resultant weight gain. Hence, a sustained deficit of intake to expenditure leads to fat reduction and weight loss.

The food pyramid guide is available free from the U.S. Department of Health and Human Services. It represents consensus of scientific thought on diet composition for good health. Its strengths include a common sense approach to making food choices that meet all known human nutrient as well as energy needs. Note that "choices" allow individuals to select nutrient comparable foods according to individual tastes. It is not a quick weight reduction scheme but a true guide for healthy diet planning.

This simple guide used in conjunction with daily exercise can assist in obtaining and maintaining a healthy weight.

Thank you Dr. Stoutt. I've spent years counseling clients and your article was the most succinct and accurate information for the general public that I've reviewed in a long time. I'm toasting you with my glass of skim milk!

Sandy J. Wickham
Registered Dietitian and pilot
Via the Internet

Thank you for your comments. I refuse to admit that I might be one of those "gaining" Americans, but I will say my airplane has lost a few pounds of useful load. The sad thing is every six pounds of extra body fat costs each of us one gallon of avgas for trip planning purposes.

• Who Put the Barb in the Procedure Turns

I have a couple of questions about procedure turns. I know I should be able to get the straight scoop from the FAA so here it is. Unfortunately, I let my *FAA Aviation News* subscription lapse so until I re-subscribe an e-mail reply would be appreciated.

1. Is there any specific reason why Jeppesen approach charts depict the procedure turn as a 45-degree type turn and why the NOS charts depict a 45-degree barb? It is my understanding that I can reverse course in any

manner I choose as long as I remain within the distance specified on the chart on the side of the FAC shown by the barb, i.e. within the procedure turn area defined by TERPS.

2. Why not show only the direction of the procedure turn by a barb without any heading information and leave the rest to the pilot? I have found that in some high-speed aircraft it is more elegant to reverse course using a teardrop procedure rather than a 45-degree type or the 80-260-type reversal. In fact, some may think that the procedure turn must be done as depicted which is incorrect unless it is a holding pattern or teardrop.

Bill de Groh
Via the Internet

The Flight Standards Service's Flight Technologies and Procedures Division (AFS-400) provided the following answer.

The U.S. Terminal Procedures Publication (TPP), as well as instrument procedures published by Jeppesen, Inc., depicts procedure turn direction and heading information based on a 45°-course reversal method. In both cases, the portrayal of the procedure turn heading information is for pilot convenience to preclude the need for in-cockpit computation of the respective procedure headings.

Early in Jeppesen's history it was decided to portray the 45/180-course reversal pattern as a "Jeppesen portrayal standard" primarily because it was the more common course reversal used in the U.S. In fact, Jeppesen portrays the 45/180 standard worldwide, unless the country specifies preferred course reversal type of specifically precludes use of the 45/180-course reversal.

The 45-degree off-course heading is charted in the U.S. Government TPP because it is the most common course reversal method used for procedure turns. Charting specifications for the TPP stipulates: "The procedure turn shall be shown by a barb symbol…the barb shall be positioned on the maneuvering side…inbound and outbound 45-degree off-course bearing values (directional arrow with inbound value only) shall be shown on either side of the procedure turn barb."

Limitations on procedure turns are explained in the Aeronautical Information Manual (AIM), paragraph 5-4-8a 1: "On U.S. Government charts, a barbed arrow indicates the direction or side of the outbound course on which the procedure turn is made. Headings… are provided using the 45-degree type procedure turn. However, the point at which the turn may be commenced and the type and rate of turn is left to the discretion of the pilot. Some of the options are the 45-degree procedure turn, the racetrack pattern, the teardrop procedure turn, or the 80/260-course reversal.

Some procedure turns are specified by procedure track. These turns must be flown exactly as depicted."

IACC also specifies that the legend describing this feature (the PT barb) shall indicate that the use of these values is not mandatory. To this end, U.S. Government charts state in the TPP legend: "(Type, degree, and point of turn optional)."

The FAA recommends that, in the interest of safety, the procedure turn should be flown as depicted on the chart. However, virtually any type of course reversal is allowed, provided it is executed on the correct (depicted) side of the procedure, and provided the aircraft does not exceed the allowed maneuvering area shown on the procedure.

The one caveat to the preceding statement is where a teardrop or racetrack (holding pattern) course reversal track is depicted, the course reversal must be flown as depicted.

FAA AVIATION NEWS welcomes comments. We may edit letters for style and/or length. If we have more than one letter on the same topic, we will select one representative letter to publish. Because of our publishing schedules, responses may not appear for several issues. We do not print anonymous letters, but we do withhold names or send personal replies upon request. Readers are reminded that questions dealing with immediate FAA operational issues should be referred to their local Flight Standards District Office or Air Traffic facility. Send letters to H. Dean Chamberlain, FORUM Editor, FAA AVIATION NEWS, AFS-805, 800 Independence Ave., SW, Washington, DC 20591, or FAX them to (202) 267-9463; e-mail address:

Dean.Chamberlain@faa.gov

• F-16?

Others have probably beaten me to the punch, but on page 12 of the July/August 2000 issue isn't that the silhouette of an F16, not of an F15?

Anthony Boerio,
USAIRWAYS
Via the Internet

It probably is. The illustration is used generically. Our designer used what he had available to show a military type aircraft.

Thanks for your comment. It is good to know someone is looking at the magazine with a critical eye.

FAA Releases CD-ROM on ATC System

The Federal Aviation Administration (FAA) and National Aeronautics and Space Administration (NASA) has announced release of a jointly produced educational CD-ROM, "Gate to Gate," which offers a unique trip through the nation's busy air traffic control system.

"With this software, you can take an amazing virtual flight," said FAA Administrator Jane Garvey. "From pre-flight planning to arrival, you will see how the air traffic control system handles your flight as you fly through it. You meet some of the people who help ensure the safety of your flight and get a unique behind-the-scenes look at the tools used to manage today's busy air traffic control system. You can even see a few of the new technologies being deployed to handle the projected growth in the future."

"Gate to Gate" includes separate learning modules on the pre-flight, takeoff, departure, en route, descent, approach, and landing phases of a flight to explain how the air traffic control system works. This self-paced software uses lively animations, Quicktime Virtual Reality video clips, and a host of interactive learning activities and can be used on most Macintosh and IBM-compatible personal computers.

To request a copy, contact the FAA at <karen.stewart@faa.gov>.

Land and Hold Short Operations

According to a Federal Aviation Administration (FAA) media release, the FAA, the airlines, airline pilot groups and others in the aviation industry have reached agreement on continuing Land and Hold Short Operations (LAHSO). As a result, the FAA will issue an order implementing changes to LAHSO. The order, which went into effect August 14, will permit expanded use of LAHSO and thereby increase the capacity and efficiency of the air traffic system.

LAHSO is an aviation procedure that has been used safely since 1968. It increases capacity at airports with intersecting runways by allowing aircraft to land and stop on long runways before an intersection with another runway. Stopping short allows the air traffic controller to have another aircraft take off or land on the intersecting runway. LAHSO have been refined through years of operational experience and cooperation among the FAA, airlines, pilots and controllers.

FAQ, the Continuing Saga, Part 3

In the last issue of our magazine, our intrepid readers questioned the whereabouts of the "New FAR Part 61 Q & A Website" announced on our July/August AvNEWS page. The directions didn't work, because the webpage had been reformatted.

In the September issue on the Forum page we gave new, more detailed directions. These directions still do work, but a shortcut has been made which will make getting to the FAQ's much easier. As of this issue, the shortcut is:

1. Key in URL <http://afs600.faa.gov>
2. Click on [SEARCH] on the left
3. Scroll down Select directory to search and highlight [FAQ(640)]
4. Click on [SEARCH] on the right
5. This should give you three choices:

- "faqspt61.pdf" - Part 61 FAQ's
- "faqpt141.pdf" - Part 141 FAQ's
- "aero-exp.pdf" – contains the aeronautical experience checklist to assist in checking an applicant's FAA Form 8710-1, Airman Certificate and/or Ratings.

PAMA Courses Now Available Online

The Professional Aviation Maintenance Association (PAMA) and Aerolearn.com have formed a strategic partnership to deliver PAMA symposium seminars through Aerolearn.com's online learning community. The partnership, known as the PAMA 2000 Online Learning Initiative, makes PAMA seminars available to the aviation industry anytime and anywhere. Aerolearn.com will deliver the seminars in its online course format with each course site providing the presentation materials and such interactive communication tools as discussion boards, virtual chat rooms, and online whiteboards.

Aerolearn.com's capabilities include several methods for verification of training. As part of this partnership, PAMA and Aerolearn.com will work with the FAA to seek IA approval for some of the online courses. Many of the seminars presented at PAMA 2000 are already online. The courses are listed under the "PAMA Courses" heading on Aerolearn.com's virtual campus.

Aerolearn.com, the Learning Community for Aviation Maintenance Professionals, offers free web-based courses in an online knowledge hub created for and by industry professionals. For more information, contact Fred Malzahn, Aerolearn's Director of Industry Relations, at 949-442-8830, email fred@aerolearn.com, or visit <http://www.aerolearn.com>.

Or contact Christina Vloet, PAMA's Communications Manager, at 202-730-0260, e-mail christinav@PAMA.org, or visit <http://www.pama.org>.

AvNEWS

NASA AND FAA ANNOUNCE DESIGN COMPETITION WINNERS

1st Prize

A student team has designed an airplane that can double as a car to offer true door-to-door service. NASA and the FAA recognized this and other university student teams for their innovative designs by presenting the 1999-2000 National General Aviation Design Competition awards at a ceremony at AirVenture 2000 at Oshkosh, WI. The first place award was presented to a 28-student team from Virginia Tech, Blacksburg, and its collaborating partner, Loughborough University, Leicestershire, United Kingdom. The award provides $3,000 to Virginia Tech's design team members and a $5,000 award to Virginia Tech's Department of Aerospace and Ocean Engineering.

The team, which dubbed its design "Pegasus," undertook the challenge of designing an aircraft that would be "roadable" — capable of both ground and air travel. They also had to meet safety and operational regulations for both aircraft and automobiles. The ability to switch from aircraft to car-like operation allows such a vehicle to effectively utilize small airports. The team recognized that the cost to actually produce such an aircraft would exceed today's typical general aviation aircraft cost; however, the students believed the additional cost should readily be offset by the convenience of not having to have a car for ground transportation.

Second place honors went to a seven-student team from Purdue University, West Lafayette, IN, for the "Silairus 490," a six-passenger, high-performance piston engine aircraft with an Air Cushion Landing System (ACLS) in lieu of traditional landing gear. The second place award provides a $2000 prize to the student team. The Purdue team also won the Best Use of Air-Force- Developed Technology award for its incorporation of the ACLS, developed by the United States Air Force. For this award, the team will share a $3,000 prize from the Air Force. Third place prizee of $1,000 was awarded to Pennsylvania State University, University Park. The team's design, called "Alnighter," is a modern, composite general aviation aircraft. The Best Retrofit Design Award was presented to a four-student, University of Oklahoma, Norman, team for development of an innovative, multi-mode tuned-exhaust system that offers noise reduction while improving the airplane's performance. The design was undertaken as a part of a larger aircraft design project to show how an older aircraft can be retrofitted with more modern technologies for increased performance and safety. The award's sponsor, the Aircraft Owners and Pilots Association Air Safety Foundation, presented a $500 award to the student team.

2nd Prize

NASA photos.

Now in its sixth year, the competition calls for individuals or teams of undergraduate and graduate students from U.S. engineering schools to participate in a major national effort to rebuild the U.S. general aviation sector. For the purpose of the contest, general aviation aircraft are defined as single or twin engine (turbine or piston), single-pilot, fixed-wing aircraft for two to six passengers. The competition seeks to raise student awareness of the importance of general aviation by having the students address design challenges for a small aircraft transportation system. NASA and the FAA hope to stimulate breakthroughs in technology and their application in the general aviation marketplace. The Virginia Space Grant Consortium manages the competition for NASA and the FAA. Guidelines can be requested from msandy@odu.edu or at (757) 865-0726.

Editor's Runway

from the pen of Phyllis-Anne Duncan

'Scuse Me, While I Kiss the Sky

On May, 24, 1976 I ditched work. (Don't worry. It was before I came to work for the Friendly Aviation Administration, so no taxpayer money was wasted.) That day, something remarkable was going to happen, and I decided that 150 7th graders didn't really need me to teach pre-algebra. I headed toward Dulles International Airport, then literally in the middle of nowhere, to be witness to the first landing of the Concorde. Back then, I thought that an aircraft travelling faster than the speed of sound was the height of aviation technology, and I'd read *Popular Science* after all: We were destined to have hundreds of them hurtling around the earth on the edge of space. As a teenager I had followed the design and production of Concorde and the now defunct U.S. SST with the enthusiasm that the youth of today reserves for 'N Sync and Brittany Spears (go figure). So, to have the opportunity to see this sleek, futuristic aircraft in flight was a desire that I couldn't overcome. (Try dealing with 150 7th graders for nine months out of the year!)

Apparently, several thousand other people in Northern Virginia also had the same lack of commitment to work and love of aviation as I did that day, because a massive traffic jam clogged the Dulles Access Road in the direction of the airport. We literally came to a standstill, but rather than exhibit the road rage of today, we all exited our cars, craned our faces to the sky, and shielded our eyes against the sun. The wait was not long. Looking ever so much like the spaceships I longed to pilot, the Concorde roared overhead on approach to IAD. It was the sound that the old Stage I and II engines make, the sound that makes your sternum vibrate and displeases the noise-conscious. To me and several thousand other people standing in the middle of a highway, it was a sweet sound. When the needle-nosed aircraft grew smaller and the sound ebbed, a song emerged from someone's car radio—a Jimi Hendrix tune with the lyric, "'Scuse me while I kiss the sky!" It gave me a chill then, and it gives me one now in recollection of a perfect VFR day and an absolutely beautiful aircraft.

Over the past several weeks I've been contrasting that once-in-lifetime image with the stark July 2000 photograph from France—a sister aircraft to the one I saw, struggling to stay in the air, flames pouring from those incredible engines. Despite what some may say about "hard-hearted" federal bureaucrats, when an accident occurs, we in the FAA feel it, even if we have no association with investigating it, and we all felt a loss that day. Some of us, who had skipped work or school 24 years ago, probably made the same contrast and felt loss and compassion for 114 lives and a magnificent aircraft which, on that first time she came to Dulles, looked as if she had no other purpose than to "kiss the sky."

Even before a probable cause has been determined by the French authorities, some are indicating that one fatal accident in a quarter-century means the end of the SST. None are on the drawing board, the remaining fleet is old technology, and the Concorde has always suffered the stigma of being the toy of the rich. There are less expensive, more energy efficient, and less polluting ways to travel, but nothing which holds the promise for the future that Concorde did. Her very name—Concorde—symbolized a coming together of countries, companies, technology to achieve an ideal of accomplishment and flight.

Because I am a human being and even though they are strangers to me, I mourn the loss of those lives on board Concorde and on the ground. Because I am an aviator, I will also mourn the loss of a machine born from a dream and whose very image in the sky was a fulfiller of others'. I hope for the sake of the families of the dead that the cause is determined and restitution made—though nothing makes up for the loss of a loved one. I hope for the sake of history that Concorde flies again.

'Scuse me, while I kiss the sky.

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